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500 may include any number of transport wires 103-1 through 103-N (with associated transmission channels 104-1 through 104-N, respectively) carrying input signal streams  $x_{k,1}$  through  $x_{k,N}$ , respectively.

[0073] Receiver system 500 includes receivers 501-1 through 501-N, one for each of lines 103-1 through 103-N, respectively. Receiver 501-j, an arbitrarily chosen one of receivers 501-1 through 501-N, includes filter/digitizer 502-j, equalizer 505-j, and coefficient update 506-j. Signal  $x_{k,j}$  from wire 103-j is received by filter/digitizer 502-j. Filter/digitizer 502-j filters, digitizes and amplifies the signal  $x_{k,j}$  and outputs a signal  $y_{k,j}$ . Equalizer 505-j receives the signal  $y_{k,j}$ , equalizes it to remove the effects of intersymbol interference, and outputs a signal  $a'_{k,j}$ , which is the output signal for receiver 501-j. Filter/digitizer 502-j can be arranged to include filters that partially remove the ISI from signal  $x_{k,j}$  before digitizing the signal. See, e.g., U.S. Patent Application 09/561,086, Manickam et al., filed on the same date as the present application, assigned to the same assignee as the present application, herein incorporated by reference in its entirety.

[0074] Coefficient update 506-j inputs decided-on symbols  $\hat{a}_{k,j}$  and other parameters and adaptively chooses parameters for filter/digitizer 502-j and equalizer 505-j (e.g., amplifier gain, multiplier coefficients, filter parameters, echo cancellation, NEXT cancellation, and timing parameters).

[0075] One skilled in the art will recognize that each of receivers 501-1 through 501-N can be different. That is, each of filters/digitizers 502-1 through 502-N and equalizers 505-1 through 505-N can be individually matched to receive input signals from the corresponding one of wires 103-1 through 103-N.

[0076] Figure 5B shows a representative example of receiver 501-j. Receiver 501-j is one of receivers 501-1 through 501-N. Receiver 501-j includes filter/digitizer (or receiver/digitizer) 502-j in series with equalizer 505-j. Receiver/digitizer 502-j includes, in series, filter/echo canceller 508-j, analog-to-digital converter (ADC) 509-j, and amplifier 510-j. One skilled in the art will recognize that the order of these components can be altered from that shown in Fig. 5B. For example, amplifier 510-j can be implemented before filter/echo canceller (or simply filter) 508-j, or filter 508-j can be implemented, completely or partially, digitally after ADC 509-j.

[0077] Parameters to control the components of receiver 501-j can be adaptively chosen by coefficient update 506-j. Coefficient update 506-j adaptively determines the equalizer coefficients of equalizer 505-j, the gain  $g_j$  of amplifier 510-j, the timing coefficient  $\tau_j$  of ADC 509-j, and filter coefficients for filter 508-j. In some embodiments, coefficient update 506-j can calculate a baseline wander correction signal  $w_j$  which is subtracted from the output sample of ADC 509-j at baseline wander correction adder 511-j. Baseline wander correction is discussed in U.S. Patent Application 09/151,525, filed September 11, 1998, Raghavan, assigned to the same assignee as the present application, now U.S. Patent 6,415,003, herein incorporated by reference in its entirety.

[0078] Some embodiments of receiver 501-j include a cable quality and length indicator 512-j that indicates a wire length L and wire quality Q.

[0079] Echo noise, which is a result of impedance mismatches in the duplex link causing some of the transmitted signal energy to be reflected back into a receiver, and near end crosstalk (NEXT) noise, which is caused by the interference from a transmitter, i.e., transmitter 110 (Figure 1), physically located adjacent to